Technology Fact Sheet for Adaptation

L. Hydroponics/Soilless Agriculture [i]

Technology characteristics	
Introduction	The development of new techniques to improve protected agriculture, particularly the adoption of hydroponics/soilless culture, can contribute to the preservation of the water resource and thus to food security. Soilless cultivation is intensively used in protected agriculture to improve control over the growing environment and to avoid uncertainties in the water and nutrient status of the soil. It also overcomes the problem of salinity and the accumulation of pests and diseases. This technique offers good yields and quality of products yet, it requires high technical levels and investment costs. To increase its cost-effectiveness and it's efficiency to cope with climate change, it can be topped up by other adaptation technologies namely Integrated Production and Protection in greenhouses. The technology contributes to climate change adaptation primarily through: - Targeting food security by improving crop productivity - Reducing the pressure on water resource and saving water
Technology characteristics/highlights	Soilless culture has 2categories: - Water culture or liquid non-aggregate hydroponic systems where the nutrient film technique (NFT) is the most common type. - The substrate culture or aggregate hydroponic systems (open and closed systems) and natural organic substrates. Different kind of inert substrates are used in soilless culture: perlite, sand gravel, vermiculite, rockwool, pozzolana. Organic substrates (peat, peat based mixtures and sawdust) have been widely used but they decay quickly due to microbiological actions and also they react chemically with the nutrient solution; therefore it is necessary to interfere in the growing process, to adjust by the frequency of the nutrient application the changes in the EC and pH. The following elements could be mainly needed when mounting a hydroponic soilless system: - Monitoring equipment: It is a computerized system that has the duty of controlling, monitoring and distributing the nutrient solution. Also this computer is able to regulate pH and EC according to the required values. - Fertigation unit: coupled with a pump that allow to carry water from reservoir to tanks made from plastic material and equipped with screen filters and valves for the micro and macronutrient solutions, and for nitric acid which is essential for automatic pH control of nutritive solution. - Injection pumps: controlled by the computer, supplying the proper amount of stock nutrient solution to a mixing tank. - Nutrient solution mixing tank: where the settled amounts from stock

	nutrient solution are mixed to get the required value of EC and pH. Then, the irrigation nutrient solution can be distributed to the irrigation system. - Irrigation unit: Nutritive solution is carried to plants through an irrigation system. - Benches and troughs: The benches serve as support for the growing media containers. The trough is the container of the growing media.
Institutional and organizational requirements	No institutional requirements. The development of this high technology requires optimal financing mechanisms.
Operation and maintenance	Training is essential for the good operation and maintenance of the computerized system that ensure mixing of appropriate amounts of nutritive solution with water, monitoring of EC and pH and solution distribution to the irrigation system.
Endorsement by experts	Today, hydroponics is an established branch of agronomy. Progress has been rapid, and results obtained in various countries have proved it to be thoroughly practical and to have very definite advantages over conventional methods of horticulture.
Adequacy for current climate	Fits well, both for present and expected climate
Scale/Size of beneficiaries group	The size of the beneficiaries remains limited to horticulture crops and cut flowers growers, mainly those who cultivate under greenhouses.
Disadvantages	- High capital cost - High qualified farmers acquainted to this closed system are a must. - Substrate cultures don't have a buffer capacity similar to that of soil, so any error in fertilization program will be amplified. - Environmental impact: if the used systems are open substrate culture with non-recirculating nutritive solution which is directly eliminated in greenhouse soil, groundwater pollution could take place. It is therefore recommended to use closed substrate systems. - Higher consumption in energy to maintain the production system.
Capital costs	
Cost to implement adaptation technology	There are some challenges to soilless farming, particularly; it requires technological investment and modern equipment, but because the revenue from crops is to be maximized, the system can pay for itself in just few years.
Additional cost to implement adaptation technology, compared to "business as usual"	The substrate cost is lesser than land preparation and soil disinfection. If we consider that greenhouse structure and fertigation network already exist, the additional costs will be related for upgrading the system to enable recycling of the nutrients and water, and to control the microclimate. The main additional cost is to maintain continuous electric energy for the well-functioning of hydroponic systems.
Development impacts, direct and indirect benefits	
Direct benefits	Since this technology is under greenhouses, allowing a longer growing season, planting and harvesting dates are more flexible enabling producers to respond better to market opportunities; it avoid problems of soil infection and overuse so that farmers can produce the same crop

	longer; and it allows more efficient use of water and nutrients. Land preparation and soil disinfection are avoided. Production is optimal and the cost of production is lower.
Reduction of vulnerability to climate change, indirect	Hydroponics/soilless culture is adapted to climatic constraints like wind and temperature variations and increase water efficiency and protect the plants from increased water demand under future climate scenarios.
Economic benefits, indirect Employment Growth & Investment	 Creation of jobs to support construction of hydroponics systems and to provide training to users Can create investments in importing systems from foreign countries, also it can promote local production of material especially substrates.
Social benefits, indirect Income Education Health	 Farmers' income is higher than those producing into conventional greenhouses. Training elements from capacity building Improved income improves school attendance Improving health through better quality of obtained products: safe and free from diseases.
Environmental benefits, indirect	Promotion hydroponics will reduce soil degradation and ensure sustainable use of water resource.
Local context	
Opportunities and Barriers	Using hydroponic culture in Lebanon will offer different opportunities particularly through addressing production inefficiencies and gaps and improve food security under future climate uncertainty. Soilless culture enables production in any land, without have the soil as a limiting factor. Hence, agriculture lands that are facing salinity on the coastal area or in the northern Bekaa can be re-exploited through hydroponic system. Barriers are mainly attributed to the absence of agriculture credits and loan facilities, the capital cost, energy requirement, and the lack of expertise of Lebanese farmers and technicians in this field.
Market potential	The market is open to horticulture grower and small holders, aiming at exploiting their land through a competitive production system.
Status	The first initiative in Lebanon is through the U.S. Agency for International Development (USAID) which launched a five-year project (2010-2015): the Developing Hydroponics to Access International Markets (DHAIM).
Timeframe	The implementation can start on the short or medium term.
Acceptability to local stakeholders	Easy to accept for all involved stakeholders.

[i] **This fact sheet has been extracted from TNA Report – Technology Needs Assessment Reports For Climate Change Adaptation – Lebanon. You can access the complete report from the TNA project website http://tech-action.org/**